

1 CLAIMS

2 What is claimed is:

3 1. A method for representing interconnection of a
4 plurality of elements on a network, the method
5 comprising:

6 providing a first catalog for a first subset of
7 said elements, and providing a second catalog for
8 a second subset of said elements;

9 creating a matrix of connection cells formed by an
10 intersection of a pair of elements, wherein a
11 first element of each pair is taken from the first
12 catalog and a second element of each pair is taken
13 from the second catalog; and

14 forming a connection representation for at least a
15 subset of the pairs.
16

17 2. A method as recited in claim 1, wherein at least one
18 element is a catalog of sub-elements, and the method
19 further comprises the step of including all
20 sub-elements in the matrix.

21 3. A method as recited in claim 1, wherein the network
22 is a communications network and at least a subset of
23 the elements includes routers.

1 4. A method as recited in claim 1, wherein the network
2 is an IP network and at least a subset of said elements
3 have an IP protocol stack.

4 5. A method as recited in claim 1, wherein at least one
5 particular element in the first catalog is the same as
6 a particular element in the second catalog.

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8 6. A method as recited in claim 1, wherein at least one
of the catalogs includes a plurality of sub-catalogs.

9 7. A method as recited in claim 1, wherein at least a
10 portion of the network is a computer network.

11 8. A method as recited in claim 1, wherein at least a
12 portion of the network is a virtual network.

13 9. A method as recited in claim 1, wherein at least a
14 portion of the network is a network implemented using a
15 layer above a physical layer.

16 10. A method as recited in claim 1, wherein at least a
17 portion of the network is an overlay network.

18 11. A method as recited in claim 10, wherein at least a
19 portion of the overlay network is an IPSec network.

20 12. A method as recited in claim 10, wherein at least a
21 portion of the overlay network provides Quality of
22 Service.

1 13. A method as recited in claim 10, wherein at least a
2 portion of the overlay network is an MPLS network.

3 14 A method as recited in claim 1, wherein the network
4 includes VLANs.

5 15. A method as recited in claim 1, further comprising
6 the step of configuring at least a portion of the
7 network employing the representation.

8 16. A method as recited in claim 1, wherein at least a
9 portion of one catalog is formed using combinatorial
10 operations upon elements of other catalogs.

11 17. A method as recited in claim 1, further comprising
12 associating at least one task with at least one
13 connection.

14 18. A method as recited in claim 17, further
15 comprising triggering at least said one task as a
16 result of a change of a state of said one connection.

17 19. A method as recited in claim 1, wherein at least
18 one of the elements is an abstract entity.

19 20. A method as recited in claim 19, wherein an
20 element embodies the attributes of Quality of Service.

21 21. A method as recited in claim 19, wherein an
22 element embodies the attributes of security.

- 1 22. A method as recited in claim 1, wherein at least
2 one of the elements is a physical entity.
- 3 23. A method as recited in claim 1, further comprising
4 displaying at least one portion of the matrix.
- 5 24. A method as recited in claim 1, further comprising
6 monitoring at least one portion of the matrix.
- 7 25. A method of claim 1, wherein the matrix is
8 structured such that elements of a row are different
9 from elements of a column.
- 10 26. A method of claim 25, wherein at a least a portion
11 of the connections form a star network.
- 12 27. A method of claim 1, wherein the matrix is
13 structured such that elements on a the row are
14 identical to elements on a column.
- 15 28. A method of claim 27, wherein at a least a portion
16 of the connections form a mesh network.
- 17 29. A method as recited in claim 2, wherein at least
18 another element is a second catalog of sub-elements and
19 the method further comprises the step of forming a
20 sub-matrix of said one element with said another
21 element.
- 22 30. A method as recited in claim 1, further comprising
23 employing a wizard to form at least a subset of the
24 elements.

1 31. A method as recited in claim 1, further comprising
2 initializing all connections to a connected state.

3 32. A method as recited in claim 1, further comprising
4 employing a wizard to determine which connections to be
5 brought to a connected state.

6 33. A method as recited in claim 1, further comprising
7 initializing all connections to a non-connected state.

8 34. A method as recited in claim 1, further comprising
9 choosing at least one pair upon which a manipulation is
10 performed.

11 35. A method as recited in claim 34, further comprising
12 modifying at least one changeable attribute of the
13 connection.

14 36. A method as recited in claim 35, further comprising
15 causing an inheritable change to be inherited by a
16 group of inheritors.

17 37. A method as recited in claim 36, wherein a first
18 element is a first gateway, a second element is a
19 second gateway, and the attribute is setting a security
20 policy, and the step of causing causes the security
21 policy to be set at all elements included in the first
22 and second gateway.

23 38. A method as recited in claim 36, wherein a first
24 element is a catalog of sub-elements, and the attribute

1 means embodied therein for causing an interconnection
2 representation of a plurality of elements on a network,
3 the computer readable program code means in said
4 article of manufacture comprising computer readable
5 program code means for causing a computer to effect:

6 providing a first catalog for a first subset of
7 said elements, and providing a second catalog for
8 a second subset of said elements;

9 creating a matrix of connection cells formed by an
10 intersection of a pair of elements, wherein a
11 first element of each pair is taken from the first
12 catalog and a second element of each pair is taken
13 from the second catalog; and

14
15 forming a connection representation for at least a
16 subset of the pairs.

17 47. An article of manufacture as recited in claim 46,
18 wherein at least one element is a catalog of
19 sub-elements, and the method further comprises the step
20 of including all sub-elements in the matrix.

21 ^{48.}
^{R1.126} 47. An article of manufacture as recited in claim 46,
22 wherein the network is a phone network and at least a
23 subset of the elements includes switches.

24 ^{49.}
^{R1.126} 48. An article of manufacture as recited in claim 46,
25 the computer readable program code means in said
26 article of manufacture further comprising computer
27 readable program code means for causing a computer to

1 effect configuring at least a portion of the network
2 employing the representation.

3 ^{RI.126} ~~50.~~ ^{51.} An article of manufacture as recited in claim 46,
4 the computer readable program code means in said
5 article of manufacture further comprising computer
6 readable program code means for causing a computer to
7 effect associating at least one task with at least one
8 connection.

9 ^{RI.126} ~~50.~~ ^{51.} An article of manufacture as recited in claim 49,
10 the computer readable program code means in said
11 article of manufacture further comprising computer
12 readable program code means for causing a computer to
13 effect triggering at least said one task as a result of
14 a change of a state of said one connection.

15 ^{RI.126} ~~51.~~ ^{52.} An article of manufacture as recited in claim 46,
16 the computer readable program code means in said
17 article of manufacture further comprising computer
18 readable program code means for causing a computer to
19 effect choosing at least one pair upon which a
20 manipulation is performed.

21 ^{RI.126} ~~52.~~ ^{53.} An article of manufacture as recited in claim 51,
22 the computer readable program code means in said
23 article of manufacture further comprising computer
24 readable program code means for causing a computer to
25 effect modifying at least one changeable attribute of
26 the connection.

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1 ~~53.~~ An article of manufacture as recited in claim 52,
2 the computer readable program code means in said
3 article of manufacture further comprising computer
4 readable program code means for causing a computer to
5 effect causing an inheritable change to be inherited by
6 a group of inheritors.

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7 ~~54.~~ A network architecture comprising:

8 a matrix module forming a network matrix having at
9 least one matrix row element and at least one matrix
10 column element, an intersection of each said at least
11 one matrix row element with each said at least one
12 matrix column element forming a matrix cell;
13 a set of network elements, a first subset of said set
14 having a connection requirement with a second subset of
15 said set;
16 a first catalog including at least one network element
17 forming said at least one matrix row element; and
18 a second catalog including at least one network element
19 forming said at least one matrix column element,
20 wherein each matrix cell represents a network
21 connection between each network element of the first
22 catalog and each network element of the second catalog
23 to enable systematic cooperation among network elements
24 according to a network requirement.

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25 ~~55.~~ An architecture as recited in claim 54, wherein at
26 least one network element is a catalog of sub-elements.

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1 ^{57.}~~56.~~ An architecture as recited in claim 55, wherein at
2 least one of said sub-elements is another catalog of
3 sub-elements.

4 R1.126 ^{58.}~~57.~~

5 An architecture as recited in claim 55, further
6 comprising a sub-matrix module forming a network
7 sub-matrix having at least one sub-matrix row element
8 and at least one sub-matrix column element, an
9 intersection of each said at least one sub-matrix row
10 element with each said at least one sub-matrix column
element forming a sub-matrix cell;

11 at least one network element of at least a first
12 catalog forming said at least one sub-matrix row
13 element; and

14 at least one network element of at least a second
15 catalog forming said at least one sub-matrix column
16 element, such that each sub-matrix cell represents the
17 network connection between a first particular network
18 element of the first catalog and a second particular
19 network element of the second catalog.

20 R1.126 ^{59.}~~58.~~

21 An architecture as recited in claim 55, further
22 comprising a sub-matrix catalog module for including
23 all sub-matrix row and column elements in the network
matrix.

24 R1.126 ^{60.}~~59.~~

25 An architecture as recited in claim 54, wherein
the network is a water distribution network and at

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1 least a subset of the elements includes at least one
2 water main.

3 ^{RI.126} ~~60.~~ ^{61.} An architecture as recited in claim 54, wherein at
4 least one network element in the first catalog is the
5 same as another network element in the second catalog.

6 ^{RI.126} ~~61.~~ ^{62.} An architecture as recited in claim 54, wherein at
7 least one network element is a software element.

8 ^{RI.126} ~~62.~~ ^{63.} An architecture as recited in claim 54, wherein at
9 least one catalog is a software module.

10 ^{RI.126} ~~63.~~ ^{64.} An architecture as recited in claim 54, wherein
11 said first subset is identical to said second subset.

12 ^{RI.126} ~~64.~~ ^{65.} An architecture as recited in claim 54, further
13 comprising a combiner wherein at least a portion of one
14 catalog is formed using combinatorial operations upon
15 elements of the other catalog.

16 ^{RI.126} ~~65.~~ ^{66.} An architecture as recited in claim 54, further
17 comprising an associator for associating at least one
18 task with at least one connection.
19 , further comprising displaying at least one portion of
20 the matrix.

21 ^{RI.126} ~~66.~~ ^{67.} An architecture as recited in claim 54, further
22 comprising a monitor coupled to the network matrix to
23 monitor at least one portion of the network matrix.

1 ^{68.}~~67.~~ An architecture as recited in claim 54, wherein
2 the matrix is structured such that elements of a row
3 are different from elements of a column.

4 ^{68.}~~68.~~ An architecture as recited in claim 55, wherein at
5 least another element is a second catalog of
6 sub-elements and the matrix module forms a sub-matrix
7 of said one element with said another element.

8 ^{69.}~~69.~~ A method as recited in claim 1, wherein at least
9 one element is a router.

10 ^{70.}~~70.~~ An network apparatus comprising:

11 a matrix module forming a network matrix having at
12 least one matrix row element and at least one
13 matrix column element, an intersection of each
14 said at least one matrix row element with each
15 said at least one matrix column element forming a
16 matrix cell, and

17 a plurality of network catalogs, each of the
18 catalogs listing at least one network element,

19 wherein each said at least one network element of a
20 first subset of network catalogs has a connection
21 requirement with another element of said at least one
22 network element of a second subset of network catalogs,

23
24 each said at least one network element of the first
25 subset of network catalogs forming said at least one
26 matrix row element,

1 each said another element of said at least one network
2 element of a second subset of network catalogs forming
3 said at least one matrix column element, and

4 each matrix cell represents a network connection
5 between each network element of the first catalog and
6 each network element of the second catalog.

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8 ^{71.126} ~~71.~~ An apparatus as recited in claim 70, wherein at
least one network element is a catalog of sub-elements.

9 ^{73.1}
10 ^{72.126} ~~72.~~ An apparatus as recited in claim 71, wherein at
11 least one of said sub-elements is another catalog of
sub-elements.

12 ^{74.1}
13 ^{73.126} ~~73.~~ An apparatus as recited in claim 71, wherein the
14 matrix module further forms a network submatrix having
15 at least one submatrix row element and at least one
16 submatrix column element, an intersection of each said
17 at least one submatrix row element with each said at
18 least one sub-matrix column element forming a submatrix
cell;

19 each said at least one network element of a third
20 subset of network catalogs has a connection requirement
21 with another element of said at least one network
22 element of a forth subset of network catalogs,

23 each said at least one network element of the third
24 subset of network catalogs forming said at least one
25 submatrix row element,

1 each said another element of said at least one network
2 element of the fourth subset of network catalogs
3 forming said at least one submatrix column element, and

4 each submatrix cell represents a network connection
5 between each network element of the third catalog and
6 each network element of the fourth catalog.

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7 ~~74~~. An apparatus as recited in claim 73, wherein said
8 third subset is a particular element included in said
9 first subset.

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10 ~~75~~. An apparatus as recited in claim 74, wherein said
11 fourth subset is another particular element included in
12 said second subset.

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13 ~~76~~. An apparatus as recited in claim 73, wherein at
14 least one network element of the third subset has a
15 connection requirement with at least one network
16 element of the first subset, and

17 each said at least one network element of the third
18 subset is included in said at least one network matrix
19 row element.

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20 ~~77~~. An apparatus as recited in claim 76, wherein at
21 least one network element of the fourth subset has a
22 connection requirement with at least one network
23 element of the second subset, and

1 each said at least one network element of the fourth
2 subset is included in said at least one network matrix
3 column element.

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4 ~~78.~~ An apparatus as recited in claim 70, wherein at
5 least one network element of the first subset is
6 identical with one network element in the second
7 subset.

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8 ~~79.~~ An apparatus as recited in claim 73, wherein at
9 least one network element of the third subset is
10 identical with one network element in the fourth
11 subset.

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12 ~~78.~~ An apparatus as recited in claim 70, further
13 comprising an attribute modifier module to modify at
14 least one changeable attribute of at least one cell.

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15 ~~79.~~ An apparatus as recited in claim 78, wherein the
16 attribute modifier further causing an inheritable
17 change to be inherited by a group of inheritors.

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18 ~~80.~~ An apparatus as recited in claim 79, wherein a
19 first network element is a first proxy, a second
20 element is a second proxy, and the attribute is setting
21 a Quality of Service, and the step of causing causes
22 the Quality of Service policy to be set at all elements
23 included in the first and second proxies.

01.12.6

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24 ~~81.~~ An apparatus as recited in claim 79, wherein a
25 first element is a catalog of sub-elements, and the
26 attribute is setting an encryption policy, and the step

1 of causing causes the encryption policy to be set at
2 all sub-elements of the first element.

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3 82. An method comprising:

4 forming a network matrix having at least one
5 matrix row element and at least one matrix column
6 element,

7 forming a matrix cell at each intersection of each
8 said at least one matrix row element with each
9 said at least one matrix column element, and

10 forming a plurality of network catalogs;

11 listing at least one network element in each of
12 the catalogs;

13 setting said at least one network element of at
14 least one of the catalogs to be said at least one
15 matrix row element;

16 setting said at least one network element of at
17 least one of the catalogs to be said at least one
18 matrix column element, and

19 forming a representation of a connection
20 requirement of each respective matrix row element
21 with each respective matrix column element forming
22 each particular matrix cell by said particular
23 matrix cell.

~~83.~~ A method as recited in claim 82, wherein at least one matrix row element is a sub-catalog listing at least one sub-catalog network element.

4 ~~84~~. A method as recited in claim 82, further
5 comprising including said at least one sub-catalog
6 network element within said at least one matrix row
7 element.

8 ~~85~~⁸⁶. A method as recited in claim 82, further
9 comprising employing the representation in an operation
10 selected from the group consisting of displaying,
11 inheriting, configuring, administering, monitoring,
12 modeling and any combination of these operations.

86. A method as recited in claim 82, wherein the step of forming a representation of a connection includes indicating a directionality of the connection.

16 87. A method as recited in claim 1, wherein the step of
17 forming a connection representation for at least a
18 subset of the pairs includes indicating a
19 directionality of the connection.